

Spatial and Temporal Patterns of Paralytic Shellfish Poisoning Toxin (PSP) in Puget Sound

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Keywords: biotoxins, PSP, mussel, sentinel, monitoring, PSAMP

Abstract

The Washington State Department of Health (DOH) monitors biotoxins in shellfish from Washington State waters to protect shellfish consumers from harm. Each year DOH analyzes spatial and temporal trends in paralytic shellfish poisoning (PSP) toxin for the Puget Sound Ambient Monitoring Program (PSAMP). In 2004, PSP levels from 29 sentinel-monitoring sites in Puget Sound and the Straits of Juan de Fuca and Georgia (U.S. jurisdiction) were sorted into four impact categories, from none to high. Pie charts of the categorized results were plotted on a map of Puget Sound to display PSP impact Sound-wide. Seventeen sites that experienced at least minimal PSP impact were ranked with a PSP Impact Index, based on cumulative duration of PSP episodes. Port Ludlow experienced the highest PSP impact in 2004. PSP duration over the last decade (1995-2004) at selected stations was highly variable among sites and over time. PSP activity cannot be predicted due to poorly understood environmental factors. There appears to be no positive link between PSP in human activity and PSP impact in Puget Sound.

Background

The Washington State Department of Health (DOH) protects shellfish consumers by monitoring changes in levels of biotoxins in shellfish tissue. The State has monitored biotoxin levels in shellfish since the 1930s. Monitoring was greatly expanded by the 1960s. In 1990, DOH set up a Sentinel Mussel Monitoring Program to provide early warning of blooms of toxic algae leading to harmful levels PSP and other biotoxins.

Objectives

Public Health is our primary objective. When harmful levels of biotoxins are detected, DOH immediately closes commercial harvest and warns local health agencies, tribal agencies, and the public. Updated warnings are issued via print and electronic media, the DOH Biotoxin Hotline: 1.800.562.5632, and the Internet: www.doh.wa.gov/ehp/sf/biotoxin.htm

PSAMP is our secondary objective. Each year, DOH analyzes spatial and temporal trends in PSP and reports the results to the Puget Sound Ambient Monitoring Program (PSAMP). A major goal is to determine if human activity can explain changing patterns in environmental factors, including biotoxins.

Methods

Under the Sentinel Mussel Monitoring Program, several mussel species (*Mytilus edulis*, *M. galloprovincialis*, and *M. californianus*) are gathered generally semiweekly at 40 or more Puget Sound sites. Samples are collected either from wire cages suspended below floats and docks, or wild from floats, pilings, or rocks (Nishitani 1990). Seventy to 100 average-sized mussels, 1-2 inches in length, are sent to the DOH Public Health Laboratory for analysis according to procedures set by the American Public Health Association (APHA 1984). Based on completeness of record, 29 Sentinel sites were examined for status and trends in 2004.

PSAMP Analysis

Spatial Distribution of PSP (Figure 1). PSP results were sorted into “**impact categories**,” defined in the box labeled **PSP IMPACT CATEGORIES** in the legend of Fig. 1. Pie charts in Figure 1 show the proportion of PSP results in each category.

Impact-Ranking of PSP Sites (Figure 2). For each impacted site (i.e., sites in Figure 1 with gray and black pie slices), the proportion of PSP results in each category was multiplied by a “weighting factor” (“Low” proportion x 1; “Moderate” x 2; “High” x 3). The sum of the weighted proportions is the **Impact Factor** for each site. Figure 2 ranks sites by impact factor.

Annual PSP Duration (Figure 3) is the number of days in a year when PSP toxin levels in shellfish exceed the FDA safety level of 80 mg/100 g shellfish tissue. Annual duration was estimated at each Sentinel Monitoring site for the years 1995-2004. Figure 3 shows annual duration at selected PSP-impacted sites.

Observations

1. Most sites with high PSP activity were located in relatively rural areas, e.g., Port Ludlow, Miller Bay, and Discovery Bay. Some sites with low PSP activity were in urbanized areas e.g., Sinclair and Dyes Inlets, Liberty Bay.
2. Port Ludlow in Admiralty Inlet showed the highest PSP activity in 2004. Indeed, PSP activity at Port Ludlow, as measured by duration, was at a 10-year high.
3. Hood Canal, Penn Cove, Westcott Bay, and south Puget Sound east of Key Peninsula were free of PSP in 2004.
4. PSP activity at sites with histories of elevated PSP activity tends to be highly variable from year to year.
5. There appears to be no positive link between human activity and PSP impact in Puget Sound.

Conclusions

1. The time and place of PSP activity currently cannot be predicted because of highly variable data caused by interaction of many poorly understood environmental factors.
2. Protection of shellfish consumers from poisoning from biotoxins will require continued routine monitoring throughout Puget Sound and coastal waters.

References

- American Public Health Association, 1984, Laboratory procedures for the examination of seawater and shellfish, APHA, Washington D.C.
- Nishitani, L., 1990, Suggestions for the Washington PSP monitoring program and PSP research, memorandum prepared for DOH Office of Shellfish Programs, Olympia. WA. 12pp.

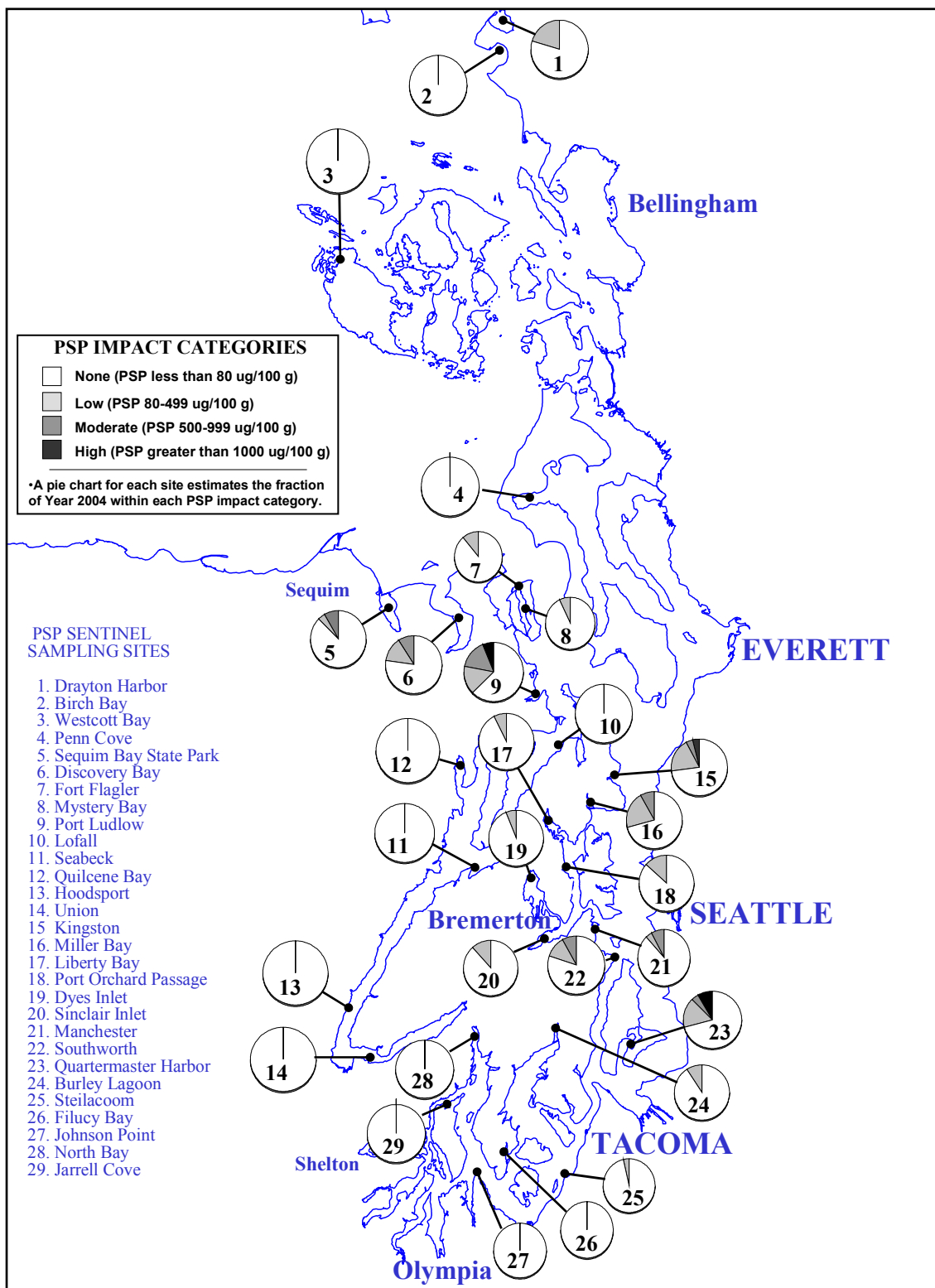
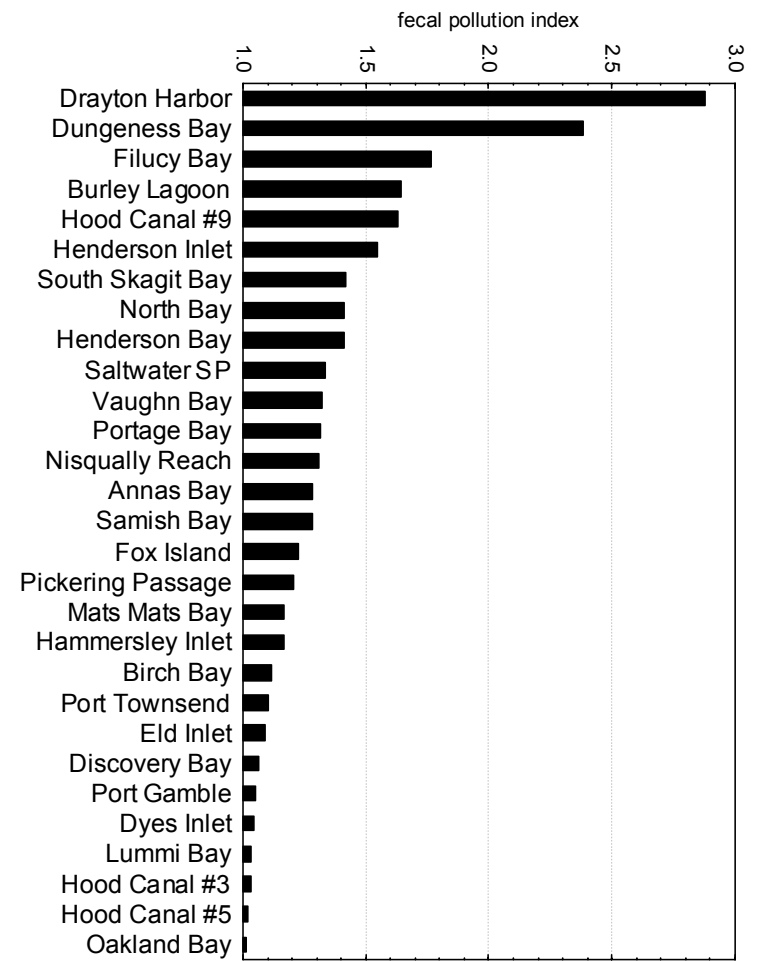


Figure 1. Summary of PSP results at PSP sentinel sites in Puget Sound in 2004.

Figure 2. Ranking of 17 of 29 total PSP sampling sites impacted by PSP in 2004.



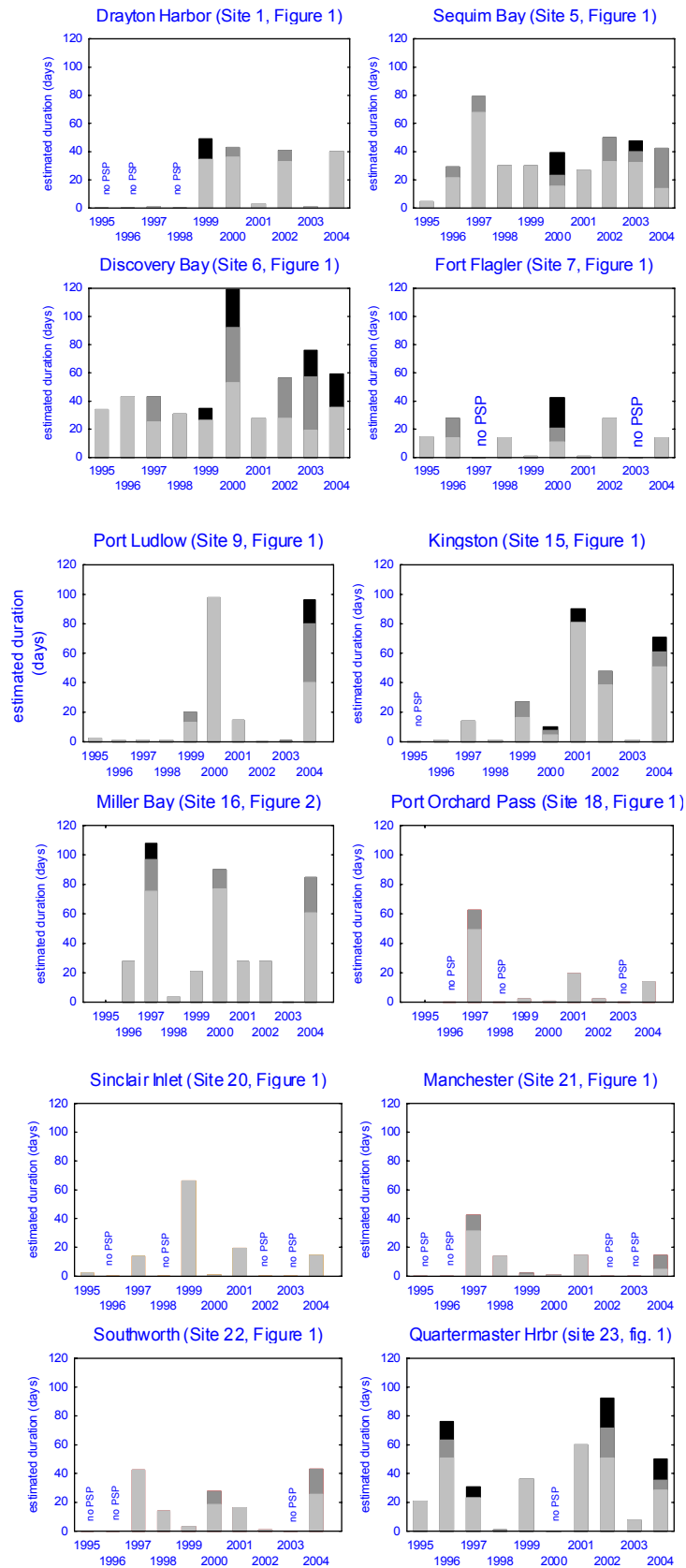


Figure 3. Duration of PSP at selected sentinel sites 1995-2005 in Puget Sound